ED 025 063

EC 002 757

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Minnesota Studies of Creative Behavior: 1958-1966.
Georgia Univ., Athens.; Richardson Foundation, Greensboro, N.C. Creativity Research Inst.
Spons Agency-Minnesota Univ., Minneapolis. Graduate School Research Fund.; Office of Education (DHEW), Washington, D.C. Cooperative Research Program.; Richardson Foundation, Greensboro, N.C.
Pub Date Feb 68
Note- 65p.
EDRS Price MF-$0.50 HC-$3.35
Descriptors- *Cognitive Processes, Creative Development, Creative Thinking, *Creativity, Creativity Research, Doctoral Theses, Educational Practice, *Exceptional Child Research, Masters Theses, Research Projects, Research Reviews (Publications), Research Utilization, Thought Processes
Identifiers-Minnesota Studies of Creative Behavior, Minnesota Studies of Creative Thinking

The impact of the Minnesota Studies of Creative Behavior on education and their contributions to educational practices are assessed; national and international extensions of the Minnesota Studies are summarized. Research is cited and interpreted. Lists are provided of 200 publications in open sources related to the Minnesota Studies and 253 master's and doctoral research papers and other research projects using tests and/or instructional materials developed by the Minnesota Studies. (JD)

MINNESOTA STUDIES OF CREATIVE BEHAVIOR:

1958-1966

E. Paul Torrance

The University of Georgia

The Creativity Research Institute

of

The Richardson Foundation, Inc.

February, 1968

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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MINNESOTA
STUDIES OF CREATIVE BEHAVIOR
1958 1966

PREFACE

In April, 1965, when I decided to leave my position at the University of Minnesota to accept my present position as head of the Department of Educational Psychology at The University of Georgia, arrangements were made to delay the move until September, 1966. My chief ambition for this period was the completion of long-overdue projects in the Minnesota Studies of Creative Behavior. I was also anxious to prepare a summary of the national and international extensions of these studies that had occupied so much of my time for the past five or six years. To assist me in the achievement of this goal, the Richardson Foundation awarded me a small grant to provide otherwise unavailable secretarial assistance.

Alas, 1965-66 proved to be unexpectedly loaded with inescapable and unanticipated demands on top of a full teaching and advising load. In spite of the fact that my wife, Pansy, and my undergraduate and graduate assistants all worked extremely hard to help me, there never seemed to be even an hour to work on the uncompleted research. During the month of July, 1966, however, I was able to complete much of this report and supervise the preparation of the stencils. For the remainder of the summer, however, it seemed necessary to give top priority to the completion of the study of mathematics teacher effectiveness and I barely managed to complete this before assuming my present duties. Once this was done, new courses, new students, new programs, the recruitment of new staff members, and other aspects of the new life demanded all of the engergy I could muster. Thus, it was not until the July 4th, 1967, holiday week-end that I was again able to take the time to complete this report.

For this untimely delay, I offer my sincere apologies to the Richardson Foundation and all of the others to whom I promised copies of the report. In addition to the obligation I have felt to carry out this promise, I have been anxious to prepare this summary for a number of other reasons. I believe that the Minnesota Studies of Creative Behavior have made a genuine impact on education both in the United States and in some other countries and that their history should be recorded, even if in this brief form. I make this statement with full humility and with recognition and appreciation of all of my associates who worked very hard and produced many of the ideas that made this impact possible. Many of them would gladly have taken the time to produce this much delayed report. Most of them, however, had been associated with the Minnesota Studies of Creative Behavior for only one to three years and had gone ahead to successful careers of their own in college teaching, educational research, editing professional journals, heading college and university departments, and the like.

I am also grateful to all those agencies whose financial support made the Minnesota Studies in Creative Behavior possible. These included the University of Minnnesota Graduate School Research Fund, the Cooperative Research Program of the United States Office of Education, the Hill Family Foundation, the Richardson Foundation, the College of Education of the University of Minnesota, and the College of Education of the University of Georgia. During the past three years, my research has had to depend largely upon the royalties from Guiding Creative Talent, Rewarding Creative Behavior, and the instructional materials co-authored with R. E. Myers and Bert Cunnington. Thus, I am grateful to those who have purchased and used these materials so generously.

I had at first intended to include in this report photographs and a list of achievements of all of those who made significant contributions to the Minnesota Studies of Creative Thinking, but this itself grew into an enormous task. Thus, I must content myself with listing their names below in alphabetical order. The achievements of several of them are told at least in part by the list of publications included in this report.

Josefina Agawin, Program in Mental Retardation, University of Minnesota, Minneapolis, Minnesota.

Nicholas Aliotti, Department of Educational Psychology, The University of Georgia, Athens, Georgia.

Kevser Arsan, Ph.D., University of Istanbul, Istanbul, Turkey.

Frank E. Baker, Ph.D., Laboratory of Experimental Design, University of Wisconsin, Madison, Wisconsin.

Mrs. Bee Bleedorn, Assistant in Department of Special Education, University of Minnesota, Minneapolis, Minnesota.

John E. Bowers, Ph.D., Haile Sellassie University, P. O. Box 1176, Addis Ababa, Ethiopia.

Pearl Buckland (School Psychologist), 1028 Gould Ave., N.E., Minneapolis, Minnesota.

Bert F. Cunnington, Free Lance Writer, 1024 West 61st Street, Minneapolis, Minnesota.

Richard K. Dawson, New Zealand Department of Education, P. O. Box 177, Lower Hutt, New Zealand.

Donald Jack Davis, Ph.D., Department of Applied Art, Texas Technological College, Lubbock, Texas.

Kenneth DeYoung, Ph.D., Department of Psychology, University of Minnesota at Duluth, Duluth, Minnesota.

Gordon R. Eastwood, Ph.D., Professor and Head, Department of Social and Philosophical Foundations, Simon Fraser University, Burnaby 2, B. C., Canada.

Som Nath Ghei, Ph.D., Department of Psychology, University of New Hampshire, Durham, New Hampshire.

Carolyn Gitzen, Educational Testing Service, Princeton, New Jersey.

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Ram K. Gupta, Department of Educational Psychology, University of Edmonton, Edmonton, Alberta, Canada.

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Adrienne KinKaid, St. Louis Park Public Schools, St. Louis Park, Minnesota.

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Harold Michie, St. Paul Public Schools, St. Paul, Minnesota.

Gerald Middents, Ph.D., Austin College, Sherman, Texas.

Myrna Minnis, Department of Educational Psychology, The University of Georgia, Athens, Georgia.

Robert (Rod) E. Myers, University of Victoria, Victoria, B. C., Canada (Summer, 1967); Department of Educational Psychology, The University of Georgia, Athens, Georgia (September, 1967).

Larry E. Orcutt, Department of Educational Psychology, The University of Georgia, Athens, Georgia.

Necla Palamutlu, School Psychologist, Robbinsdale Public Schools, Robbinsdale, Minnesota.

Harry Palm, present address not known.

Michael Pesci, National School Evaluation Project, University of Minnesota, Minneapolis, Minnesota.

Richard G. Peterson, Special Teacher, Golden Valley Public Schools, Golden Valley, Minnesota.

A. M. Prakash, Department of Psychology, University of Montana, Missoula, Montana.

Victoria Punsalan, (Research Librarian, Esso Company), P. O. Box 436, Manila, Philippines.

Herman Radig, Box 58271, Pembina, North Dakota.

Janet Ross, Ph.D., present address not known.

Bradley Sagen, Department of Higher Education, University of Iowa, Iowa City, Iowa.

Dietmar P. Schenetzki, Ph.D., Department of Psychology, Geneseo State College, Geneseo, New York.

Conchita A. Tan, Department of Educational Psychology, Queens College, Flushing, New York. (Beginning September, 1967).

V. J. Taneja, present address not known.

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Dorothy Werblo (Hammond Public Schools), RR 3, Box 236, Crown Point, Indiana.

Jing Jyi Wu, Department of Educational Psychology, Queens College, Flushing, New York. (Beginning September, 1967).

Kaoru Yamamoto, Department of Educational Psychology, University of Iowa, Iowa City.

In September, 1966, the Minnesota Studies of Creative Behavior became the Georgia Studies of Creative Behavior. Thus far, the major onslaught has been on the cross-cultural studies that are a part of a long-overdue report to the United States Office of Education. It is our ambition to complete the major report on these studies by the end of the summer, 1967. A beginning has been made on the development and use of tests of creative thinking for children from three to six years old. The University of Georgia Research and Development Center in Educational Stimulation has given partial support to these studies. Our first report on creative development in an experimental kindergarten project has just been completed and others are scheduled for publication in August and September, 1967. Thus, at least in some measure, the Georgia Studies of Creative Behavior provide continuity for the Minnesota Studies.

E. Paul Torrance
Athens, Georgia
July 4, 1967

I. STUDIES CONDUCTED AT THE UNIVERSITY OF MINNESOTA BUREAU OF EDUCATIONAL RESEARCH

1. Introduction

The Minnesota Studies of Creative Thinking originated as a part of the research program of the University of Minnesota Bureau of Educational Research. Soon after I assumed the directorship of the Bureau, it was decided through an Advisory Committee to embark on a pioneering program of research in the area of the education of gifted children and youths. Although this program of research included a number of projects not related to creative talent and creative behavior throughout its existence, it soon became apparent that the projects related to creativeness were greatly needed and were producing important information and material. Thus, much of the resources of the Bureau of Educational Research between September, 1958 and September, 1964, went into the Minnesota Studies of Creative Behavior. Since that date, I have been attempting to complete the obligations contracted during this period and I intend exerting every possible effort until this goal is achieved.

In this section of the report, I shall summarize some of the evidence concerning the impact of the Minnesota Studies of Creative Behavior on education and what I consider its major contributions. In the second section, I shall summarize some of the extensions of the Minnesota Studies nationally and internationally. In the third section, I shall present a list of publications in open sources related to the Minnesota Studies of Creative Behavior. The fourth section will consist of a partial list of master's and doctoral research reports which describe studies that have made use of tests, other data collection instruments, and instructional materials developed through the Minnesota Studies of Creative Behavior.

2. Some Indications of Impact on Education

It is probably never possible to give a comprehensive or complete picture of the impact of a research program on educational practice. Indeed, when one thinks of the vastness of the educational enterprise and the deepness of its roots in tradition, he despairs of having any marked influence of any kind on it. Thousands of letters from teachers and parents, however, testifying that their behavior has been changed with gratifying results is encouraging. That many state, regional, and national professional organizations in education have been willing to listen to me has itself been encouraging, but I remain skeptical about the influence of the meetings of professional organizations in education to change what happens in classrooms.

It is commonly recognized that one evidence of the influence of original research and theory is the amount of further investigation that it inspires. The list of master's and doctoral studies included in

Part IV documents this type of influence to some extent. Other evidences would be obtained by analyzing the citations in the professional journals and books in education. Not having the time nor resources for such a survey, I made a hurried survey of ten books in education and educational psychology for each year from 1958 to 1967 and five books on creativity for each of these years. I make no claim for the randomness or the representativeness of the sample. For the first category, I simply pulled out the first ten books I could find in education and educational psychology in my library. I avoided books with a special emphasis on creativity; all of them are textbooks used in education courses in colleges and universities. For the second category, I again pulled out the first five books on creativitiy I could find for each of the years. The name indexes of the education and educational psychology books were checked for the number of pages for which there were citations to the Minnesota Studies of Creative Behavior. In the books on creativity, notations were made both of the number of pages cited in the index and of the number of items listed in the bibliography. The results of this hurried survey are as follows:

	Education Books	Creativity Books	
Years	Number Pages Cited	Number Index Citations	Bibliography Items
1958-59	3	0	0
1960-61	2	1	2
1962-63	73	24	35
1964-65	92	83	118
1966-67	131	126	144

It will be observed from these data that not much influence of the Minnesota Studies of Creative Behavior was manifested until the 1962-63 period but that since then the influence has apparently been increasing.

A similar kind of evidence is to be found in the number of publications based on the research. In this case, I limited tabulations to books, articles, chapters in books, and reports that I had authored or co-authored and did not include the publications of any of my associates. The resulting data are as follows:

Years	Number of Publications
1958-59	39
1960-61	60
1962-63	51
1964-65	106
1966-67	64 (as of July 1, 1967)

One other evidence of influence is reflected in the special citations and honors accorded the director of the Minnesota Studies of Creative Behavior. In 1963, the American Personnel and Guidance Association cited Guiding Creative Talent as the outstanding contribution of the year 1962 in original research in the field. In this same year, I was honored by the faculty of the College of Education of the University of Delaware as Distinguished Educator of the Year and visited that University to present lectures and seminars to several classes and groups. In 1964, a committee of the National Education Association named Education and the Creative Potential as one of the two outstanding books in general education for the year 1963. In 1967, I received a citation from the National Association for Gifted Children for pioneering work in the identification and development of creative talent and one from the faculty of the Sands Point Country Day School and Academy, a center for gifted children, for outstanding achievement in the education of the gifted.

Citations in books, number of publications, and special honors are only a reflection of influence. What really matters is what happens in classrooms and the effect that this has on the development of children and youth. In some of our studies deliberate attempts have been made to assess the effects of the introduction of experimental instructional materials, certain experimental methods of instruction, and the like. These efforts, however, are indeed tiny when we view the vastness of the educational enterprise.

Some Contributions to Educational Practices

In speeches and workshops, I have used a variety of methods for summarizing the Minnesota Studies of Creative Behavior and their implications for education. The traditional pattern would be to take these studies apart project by project with a statement of purpose, methods, results, and implications for each. But the Minnesota Studies of Creative Thinking have never existed in my mind in this way, except perhaps in the reports of funded projects. Even in the reports of funded studies, however, a belongingness to a program of research is apparent. All of the experiments, descriptive studies, historical studies, and surveys have had many interrelationships. Several studies have contributed to the same objective. Most studies have contributed to several different objectives. Thus, in this section of the report, I have tried to identify what I consider some of the most important contributions of the Minnesota Studies of Creative Thinking to educational practice. To be sure, others have also contributed to the achievement of these objectives, but I shall in each case try to show the unique contribution of the Minnesota Studies to each of these achievements.

1. Removed "Creativity" from the Mystical

Prior to the research efforts of the past ten years or so, educators had been preoccupied with the personal-mystery view of the creative process. This has hampered not only the study of the creative process but has also discouraged efforts to facilitate it in educational situations. The creation of instruments to assess the creative thinking abilities, creative motivations, and the like; the designing of sequences of guided learning experiences and the production and publication of instructional materials to facilitate creative development and creative functioning in the classroom; experimentation with teaching methods designed to bring into play the creative thinking abilities have done much to take creativity out of the realm of the mystical. In all of these activites, an effort has been made deliberately to produce models of a variety of kinds of creative thinking. We have sought to produce examples in all subject matter areas, at all levels of education, and with special groups such as the retarded, the gifted, the emotionally disturbed, the blind, and the deaf, as well as with the usual classroom groups.

Whenever any aspect of human behavior is taken out of the realm of mystery, made understandable, and translated into some concrete form, educational practices are bound to be effective. In the case of the instructional materials, tests, and instructional methods, a tremendous investment of time, money, and creative energy has gone into keeping them open to examination and experimentation. As they have been evaluated and passed reasonable tests, we have endeavored to have them published in a form that will make them more useful and more easily available to other educators and researchers.

2. Developed Operational Definitions

To do sound research it is usually regarded as important to define operationally the phenomena under study. The tests of creative thinking abilities, procedures for assessing creative achievements, instruments for observing the creative processes in the classroom, devices for measuring creative motivations and personality characteristics, exercises designed to engage children in the creative process, and sequences of activities outlined in teacher guides all represent efforts to define the phenomena we have called "creativity." We have never forgotten, however, that none of these guarantee that the creative process will take place. The evidence seems quite clear, however, that all of them increase the chances that creative behavior will occur.

I have maintained that creative thinking occurs when situations call for non-habitual behavior, solutions for which the behaver has no learned responses. From the standpoint of society, an achievement would be accounted creative if it provided the society with a hitherto undiscovered solution. Since my concern has been primarily with school children, classrooms, and teachers, I have chosen to define creativity as a process whereby one becomes aware of problems, difficulties, gaps in information, missing elements, and disharmonies for which he has no learned solution; searches for clues in the situation and in existing knowledge; formulates hypotheses or possible alternative solutions; tests these hypotheses, modifies and retests them; and communicates the results.

Defining creativity in this way has certain advantages in constructing instruments, conducting research, producing instructional materials, and in making decisions about classroom management and strategies of teaching. If one accepts the above process definition, he can then ask what mental abilities or kinds of mental functioning are brought into play in the process; what personality characteristics and kinds of personality functioning facilitate the process; what kinds of teaching methods, classroom procedures, and instructional materials will facilitate the process. When products result from the process, the definition can still be used to guide the development of procedures for assessing them. In general, the three criteria suggested by Hans Selye are applicable: it must be true, generalizable, and surprising in the light of what was known at the time of the solution.

The process definition offered above follows quite closely the model of the creative process as formulated and elaborated through instructional procedures and methods by such workers as J. P. Guilford, Sidney Parnes, and others. It has been further elaborated through the instructional materials developed by Cunnington, Myers, and Torrance and by Myers and Torrance. It is a process that can be replicated in classrooms under the leadership of teachers at all levels of education. It has been demonstrated that these guided experiences result in improved skills in creative thinking. Since any skill must be practiced to be developed, it seems certain that classroom activities that replicate the process will contribute to creative development.

Some teachers have been able to generate ideas for instructional materials and methods from a somewhat more elaborate definition of creativity developed by Karl Anderson, a member of a class I taught in "Creative Ways of Teaching." In a sense this definition identifies more specifically some of the activities that have to take place for creative thinking to occur. According to this defintion, creativity is:

Wanting to know.

Digging deeper.

Looking twice.

Listening for smells.

Listening/talking to cats.

Crossing out mistakes.

Getting in deep water.

Getting through locked doors.

Having a ball.

Building sand castles.

Cutting corners.

Cutting holes to see through.

Singing in one's own key.

Plugging in the sun.

Shaking hands with tomorrow.

3. Created a Variety of Assessment Instruments

Both in the growth of knowledge and in changes in educational practices, breakthroughs are frequently heralded by the creation of new measuring instruments. The past ten years of creativity research have produced a wealth of such instruments, some rather refined and many yet quite gross and imprecise. Earlier, many instruments for assessing the creative mind and the creative personality were offered. Few of them were validated and standardized and none of them ever "caught on" in education. At the end of nine years of developmental work by my associates and me, Personnel Press, Inc. has published in a research edition alternate forms of both figural and verbal batteries. The technical-norms manual for these batteries offers a variety of test-retest reliability, interscorer reliability, and validity information. Most of these data were developed from the responses of subjects in the United States. Some of the batteries, however, have been translated into the following languages and used in comparative studies: German, Norwegian, Japanese, Chinese, Malayan, Tamil, Hindi, Gujrati, Tagalog, and Western Samoan.

Considerable developmental work has been done on batteries especially designed for use with salesmen, the social service occupations, and pre-primary children. Priority is being given to the completion of the preliminary developmental work on one of the pre-primary batteries and it is hoped that this can be completed by the end of 1967. In addition to the general purpose batteries, work has been done on a test of creative writing ability and a test of originality in imagery (Sounds and Images).

Both the tests of creative thinking ability and the test of creative writing seem to be capable of identifying gifted individuals in minority and disadvantaged groups, as well as in more advantaged groups, both in the United States and in other countries. It is true that test performances reflect differences in child rearing and educational practices among cultures, but, in my opinion, this constitutes one of the chief values of the instruments. Differences in child rearing and educational practices exist and have an influence on various aspects of intellectual development, including creative development. Procedures that would not reflect these differences would certainly be of questionable value.

Children in India performed disproportionately better on verbal than on figural tests, while children in Western Samoa and Negro children in a segregated Georgia school performed disproportionately better on figural than on verbal tests. This is not strange since the children in our Delhi, India, sample knew two or more languages and had experienced a kind of education that emphasizes verbal skills. Western Samoa has had a written language for only a short time; few of the parents of the children could read and there were few books of any kind available. The Negro children are also the product of a subculture that places little emphasis on verbal skills; the parents of some of them are unable to read and there are few books in their homes. In the United States, girls excel boys on verbal tests but not on the figural ones, while in India boys excel girls on verbal tests but not on figural ones. Again, this seems to be in accord with differences in the way the two cultures treat boys and girls.

The capacity of the tests to identify high levels of creative potentiality in disadvantaged groups and in other cultures makes possible comparative research that may provide answers or clues to answers to questions that cannot otherwise be answered.

While tests of developed abilities provide clues concerning a person's potentialities, tests that reveal personality qualities that predispose a person to use and further develop these abilities are also necessary.

Again, considerable progress has been made in developing tests of creative motivation, preferences for learning in creative ways, and procedures for helping teachers identify creative potentialities. The Personal-Social Motivation Inventory provides scores on Creative Motivation, Critical Motivation, and Power Motivation. The preliminary validation studies are quite encouraging. A very brief instrument, the What Kind of a Person Are You Test, has also yielded encouraging construct validity and will be developed further.

In addition to helping educators become aware of potentialities that might otherwise go unnoticed and assess the outcomes of new and traditional educational programs, these instruments provide models for developing measures of subject-matter achievement, sequences of learning experiences that provide practice in creative thinking, and the like.

4. Made Leaving Creative Development to Chance Unnecessary

Careful study of the lives of eminent creative people impress one with the fact that creative development has generally been largely accidental. At the same time, one is struck by the fact that even as children the eminent creative people of history engaged in creative activities and practiced the skills of thinking and personality that later enabled them to make breakthroughs that changed the world. One also finds dominant the idea that both creative development and creative achievement are matters of chance. This, of course, is in keeping with the personal-mystery view of creativity discussed earlier. Deliberate methods of creative problem-solving such as those of Osborne, Parnes, and W.J.J. Gordon have shown that creative achievement in business and industry do not have to be left to chance. Moreno's use of sociodrama and psychodrama as creative problem-solving approaches has shown that creative solutions to personal and social problems do not have to be left to chance. These are disciplined, deliberate methods that have increased though not guaranteed the occurrence of creative solutions to hitherto unsolved problems.

The experiments described in Rewarding Creative Behavior and in the evaluations of field experiments involving the ideabooks and Imagi/Craft materials, the work of Crutchfield and Covington at the University of California at Berkeley, and dozens of others have shown that creative functioning and creative development among school children can be facilitated by deliberate methods. The instructional materials developed through these research projects give classroom teachers some ready-made instructional materials which, if used intelligently and creatively, contribute to creative development. This is, of course, in keeping with a general conclusion reached prior to 1909 by Alfred Binet, the brilliant French student of the human mind and the inventor of the intelligence test that has served as a model in the entire field of intelligence testing. Binet concluded that intelligence consists of all of the little functions of discrimination, observation, retention, imagination, and the like and that all of these functions are susceptible to development through deliberate methods. Research and development activities of the past ten years have supplied a variety of methods and materials for developing what the author has labelled the creative thinking abilities. There are some indications that deliberate methods of guided, creative problem-solving both among individuals and among groups may be more effective and less time consuming than traditional methods of counseling and psychotherapy.

5. Shown That Continuity of Development is Possible

In the past, numerous investigators and observers have noted that decrements in creative functioning and participation in creative activities and ways of learning occur at about age five, nine, and thirteen, at least in the United States. It was generally assumed that these drops or discontinuities were inevitable and healthy aspects of mental and personality development. In the Minnesota Studies of Creative Behavior, however, we were unable to accept this assumption. In a series of studies, we have shown that these discontinuities do not occur under teachers who build upon the learning skills already acquired at the earlier stage and make use of activities and experiences that provide opportunity for the practice of skills in creative thinking and expression of creative personality characteristics. Comparative developmental studies have shown that the developmental curves for creative thinking abilities differ from country to country and that there are no drops in cultures that have been described as highly continuous.

From the findings accumulated from the Minnesota Studies of Creative Behavior, it now seems that the previously observed discontinuities in creative development and functioning and loss of interest in creative acitivites are man-made or culture-made rather than being inherent in the nature of man. It is true that each culture must have ways of socializing its members and that these differ from culture to culture. It is also true that the socialization processes may necessarily inhibit creative expression and growth. The indications from the Minnesota studies, however, are that if these socialization procedures are extremely harsh and result in severe discontinuities of development, the stresses may be overwhelming. It seems quite possible that the conditions responsible for these discontinuities may also be the root of future school dropouts, delinquency, and mental breakdown. It is to be hoped that a contribution to educational practice will be the development of methods of promoting a greater degree of continuity of development without sacrificing important social goals.

The Imagi/Craft materials (consisting of recorded dramatizations of great moments in scientific discovery, great moments in geographical discovery, great moments in history, and fantasies; recorded instructions for creative thinking experiences; and teacher guides to additional guided experiences in creative thinking) represent one attempt to obviate the slump in creative thinking at the fourth-grade level. The experimental materials were field tested by fifteen fourth-grade teachers in one school system and by three in each of two other systems. Control groups were drawn from fourth grade classes in the same schools. Both experimental and control classes were administered prior to and after the experimental program a battery of tests of creative thinking, tests of general educational development, the How I Like School Inventory, and Creative Activities Checklists. The growth of the subjects exposed to the experimental materials was compared with that of the subjects in the control group through appropriate tests of significance.

In the school system involving 15 experimental and 15 control classes, the control subjects showed losses rather than gains on four of the ten measures of creative thinking while the experimentals showed gains on all ten of them (eight statistically significant at better than the five percent level of confidence). In the second system, both experimentals and controls showed statistically significant gains, but the experimentals showed superior growth on three variables and the controls on one (figural elaboration). In the third system, the experimentals showed gains on all ten creativity variables while the controls showed losses on two. In all three school systems, a smaller proportion of the experimentals than the controls indicated that they "hated school." During the Christmas vacation, the experimentals reported having engaged in a larger number of creative activities on their own than did their controls in two of the school systems. During the summer vacation, the experimentals in one system reported a larger number of creative activities than their controls. In all other cases, the differences were not statistically significant. In one system, the use of the experimental materials seems to have facilitated traditional kinds of educational achievement. In the second, it seems to have made no difference. In the third, it may have interfered slightly with arithmetic achievement but made no difference in any of the other areas of achievement.

6. Shown That Different Children Learn in Different Ways

Creativity research has brought to light some quite exciting information about the way different mental abilities and skills are brought into play by different methods of instruction. This information has thrown new light on some of the earlier studies that were puzzling at the time they were completed. For example, we need no longer be puzzled by T. R. McConnell's finding in 1934 that mental age as measured by an intelligence test is more highly related to achievement in second-grade arithmetic when taught by authoritative identification than when taught by discovery methods. William Hutchinson at the University of Utah in 1963 in a study involving learning in junior high school social studies also found that, under traditional authoritarian teaching, there is a statistically significant positive correlation between mental age and achievement but not between measures of creative thinking achievement. In experimental conditions offering considerable opportunities for learning in creative ways the reverse was true.

In another 1963 study involving fifth-grade children using programmed instruction in language arts, Gotkin and Massa found significant negative relationships between measures of creative thinking and achievement. A year earilier, Stolurow at the University of Illinois had found higher positive correlations between measures of originality and achievement than between mental age and achievement with programmed materials in mathematics and statistics. The difference was that Gotkin and Massa used programmed materials that permitted only tiny mental leaps and gave little opportunity for making, identifying and correcting errors, while Stolurow's programmed materials emphasized a trouble-shooting approach that builds specific but multiple associations to a stimulus, one operational definition of the process of original thinking.

In 1964, MacDonald and Raths found that highly creative children are more productive on frustrating curriculum tasks than are less creative children. Furthermore, they enjoy such tasks more than their less creative peers do. The least creative children are less productive in open tasks, and the most creative ones react less favorably to closed tasks. Thus, pupils of varying levels of creative thinking ability react differently to different kinds of curriculum tasks and are apparently best taught by varying procedures.

Perhaps the most exciting insight that has come from creativity research is that different kinds of children learn best when given opportunities to learn in ways best suited to their motivations and abilities. In the Minnesota Studies of Creative Behavior, it has become apparent that whenever teachers change their ways of teaching in significant ways, a somewhat different group of learners become the stars or high achievers. In these studies it has also been shown that the kind of examination (multiple-choice, recall, creative applications, etc.) for which students prepare also influences what they learn.

Conclusion

A number of critics have equated the educational practices described above with progressive education, permissiveness, and lack of discipline. A careful study of the methods and materials developed by the Minnesota Studies, however, will show clearly that such a conclusion is grossly in error. It will be clear that the teaching methods described require the most sensitive and alert kind of guidance. The concept of sequences of guided learning experiences has been emphasized and has been built into the instructional materials developed by the author and his associates. The research cited points to individual differences in creative thinking abilities and motivations as important dimensions about which instruction may be individualized. Many have expressed the fear that opportunities for creative thinking will make it too easy for children. In my opinion, this is one of the most ridiculous allegations that could be made. Learning in creative ways requires expensive energies and emphasizes the self-acting rather than the receptive nature of the mind. The importance of the prepared mind and authentic information are central themes of creative ways of learning. The creative mind wants to know, digs deeper, gets into deep water, and encounters closed doors. It is also true that it makes and corrects mistakes, builds sand castles, cuts holes to see through, "sings in its own key," and "has a ball." To fail to recognize this complexity reflects a misunderstanding of the creative process and the educational practices necessary to identify and develop the creative potentialities through the educational process.

II. NATIONAL AND INTERNATIONAL EXTENSIONS OF THE MINNESOTA STUDIES OF CREATIVE BEHAVIOR

In the preceding section, an effort was made to summarize the major achievements of the Minnesota Studies of Creative Behavior. In this section, an attempt will be made to summarize a few of the major outcomes of some of the national and international studies that might be regarded as extensions of the Minnesota Studies. These extensions have made use of tests and instructional materials developed through these studies and the author and his associates have given varying degrees of assistance in their execution. In some cases this assistance has involved continuing advice and suggestions, contributions of testing materials and instructional materials, scoring of tests and in some cases actual data analysis.

There are several reasons why a published summary of these extensions of the Minnesota Studies of Creative Behavior is needed. First, a major portion of them remain in unpublished and difficult to obtain sources. Many of them give further support of exploratory findings of the Minnesota studies and increase one's confidence in their validity. Others extend and go beyond the findings of the Minnesota studies, modify, amplify, and/or challenge them. One of the most important reasons why a summary of these studies is needed, however, is that many of them examine the same problem in the same way and add little or nothing to knowledge about creative behavior. It is hoped that such a summary will enable future investigators to study these problems in different and more effective ways or examine other important issues concerning creative behavior. For example, about 100 of the investigations the author has been able to list have been concerned in some way with the relationship between measures of creative behavior and measures of intelligence. The distressing thing is not that there have been this many studies concerned with this particular problem, but that they have so rarely taken into consideration some of the dynamics of this relationship and have been too superficial to add much to our understanding of the problem.

During the past five years, about 4,000 letters of inquiry per year have been received and answered by the author. Many of these have come from investigators interested in using the author's tests of creative thinking, other original instruments used in studying creative behavior, or instructional materials developed by the author and his associates. A sample of 4,000 letters, with approximately 500 drawn randomly from each of eight years' correspondence, reveals that these extensions have indeed been national and international in scope. Each state was represented, the leading ten being New York, California, Minnesota, Illinois, Ohio, District of Columbia, Michigan, New Jersey, Pennsylvania, and Wisconsin. Thirty-six foreign countries are represented in the sample: Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, Denmark, Egypt (United Arab Republic), England, France, Germany, Greece, Guam, India, Ireland, Israel, Italy, Japan, Mexico, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Nova Scotia, Pakistan, Philippines, Puerto Rico, Scotland, Singapore, South Africa, Sweden, Taiwan, Turkey, Vietnam, and Wales. Various forms of the tests of creative thinking ability have been translated into at least twelve different languages: German, Norwegian (two different dialects), Western Samoan, Hindi, Urdu, Tamil, Gujrati, Chinese , Malayan, Japanese, Afrikaan, and Tagalog. Certain materials have also been translated into French, Spanish, Turkish, Italian, and Greek. Two books by the author--Guiding Creative Talent (1962) and Gifted Children in the Classroom (1965b)--and numerous articles have been translated into Japanese. Gifted Children in the Classroom has also been translated into Spanish and has been published in Argentina. Thus far, few original investigations outside of the United States have been published in English.

In conducting programs of research and development, it is always of great concern to know what kind of effort will have the greatest impact both on further research and on practice. On the basis of the responses that have come to the author, he would rank these efforts in the following order in terms of their impact on (1) research and (2) educational practice:

	Research	Practice
Tests and other instruments for studying phenomena	1	5
Experimental instructional materials	4	1
Books reporting and/or synthesizing original research	2	2
Professional articles in journals	3	7
Popular articles in national circulation magazines	6	3
Paper and speeches at professional meetings, conferences, etc.	7	6
Teaching, regular courses and special institutes	5	4

These data yield a very low correlation between what has an impact on research and what has an impact on educational practice (rho = .07). Although these rankings have the usual limitations of subjectivity they are based on a vast amount of data and have changed greatly from time to time throughout the past nine years. The author would, in fact, have behaved quite differently from the way he has, if he could have predicted more accurately at the outset of the Minnesota Studies of Creative Behavior what would have the most impact.

Instruments and Materials Developed

The major instrument developed through the Minnesota Studies of Creative Behavior is a set of alternate form, general purpose batteries of creative thinking ability applicable from kindergarten through graduate school (Torrance, 1966ab). In addition, there are a number of other assessment procedures suitable for studying creative thinking abilities among special age, occupational, and educational level groups. Constantly under development have been checklists of creative thinking activities of children, checklists of creative achievement of young people and adults, a personal-social motivation inventory including a measure of creative motivation, a forced-choice personality device, a creative personality checklist that may be administered in Q-sort form or alternate ways, peer- and teacher-nomination procedures, life experiences inventories, and the like. Additional devices have been developed for cross-cultural studies of creative development along with the tests of creative thinking ability. The most widely used of these is the Ideal Pupil or Ideal Child Checklist, a procedure for using the imaginative stories of children to elicit their concepts concerning divergent behavior, and a classroom questionnaire.

Three major sets of instructional materials have been developed and have been used both in research and in educational practice. The most ambitious of these is the Imagi/Craft materials developed by the author and Cunnington (1965). These now consist of a set of ten record albums with teacher guides. The recordings deal with great moments of scientific and geographic discovery, invention, and fantasy. Their goal is to aid children in learning about the nature of the creative process, the value of creative achievement, and the struggles of creative people and to engage children in creative thinking experiences similar to those described in the dramatizations of the great moments of discovery and invention and the fantasies. The initial rather large-scale field test of these materials has been described in a U. S. Office of Education report by Torrance and Gupta (1964). A second set of materials consists of sets of exercises or idea-books developed by Myers with the assistance of the author (1965abc, 1966). These materials have been used in a variety of classroom experiments in the intermediate grades and have rather uniformly resulted in creative growth as assessed by the tests of creative thinking ability. Although both sets of materials have been used as separate curriculum units, they were designed to be related to various aspects of the elementary and junior high school curriculum and to help bring about greater integration and interrelationships among the various aspects of the curriculum in the minds of pupils. The teacher guides are designed to help teachers give the kinds of guidance necessary to improve chances that these relationships will be discovered.

A third set of materials is one designed for use in teaching upper elementary pupils some of the concepts and skills of doing creative research (Torrance and Myers, 1962). Although these materials appear to have been used successfully by a number of apparently rather skilled teachers, their use has not been as widespread as has the other two sets of material.

Still another type of material has been developed for in-service workshops and other kinds of training programs. The initial materials have been described and reproduced in part in another widely available source (Torrance, 1965a). Perhaps the most widely available set of materials for this purpose is the series of ten "Classroom Creativity" articles prepared for the Instructor magazine in 1964-65.

The Three Hundred Listed Studies

During the concluding year of the Minnesota Studies of Creative Thinking, the Richardson Foundation supplied the author with a small grant to assist in the collection, listing, and summarization of the studies that represent extensions of the Minnesota Studies. Letters requesting feedback were written to correspondents who had requested permission to use some of the tests or instructional materials of the Minnesota Studies in their research. Some of them had, of course, already supplied the author with copies of their dissertations, theses, or other research reports. The letter, however, approximately doubled the number of reports and publications listed.

An analysis of the approximately 300 reports, abstracts, and journal reprints collected shows that they come from a variety of kinds of universities and other research organizations. A total of 88 colleges and universities are represented among the theses and dissertations. Although a variety of problems and issues have been investigated through these studies, four basic problems have been dominant: (1) the validity of the tests of creative thinking, (2) the relationship between creative thinking ability and intelligence, (3) the relationship between creative thinking ability and school achievement both as measured by standardized achievement tests and by teacher grades, and (4) the facilitation of creative development through specific kinds of educational experience. In addition, there have been the problems of test-retest reliability, grouping on the basis of creative thinking ability, the effectiveness of experimental instructional materials, the influence of personality and life experience variables on creative development, changing teacher behavior through in-service education, learning preferences and creative thinking ability, socio-economic status and creative development, the influence of child rearing procedures on creative development, creative functioning in such special groups as the mentally retarded and the blind, and the like.

Studies of Test Validity

The published technical-norms manual of the Torrance Tests of Creative Thinking (1966b) summarizes in considerable detail the studies that relate to the validity of the tests of creative thinking ability. Only an extremely brief summary of them will be given here. Since a person can behave creatively in an almost infinite number of ways, it is not surprising that investigators have used a variety of approaches in attempting to establish the validity of the Torrance Tests of Creative Thinking.

The author has based his own arguments for validity on the studies that come within the framework of his definition of creativity as a process through which difficulties, gaps in information, and incongruities are sensed and resolution of the resulting tension is sought through questioning, searching for additional information and new relationships, guessing or hypothesizing, testing these hypotheses, correcting them, and communicating the results. He bases his arguments for content validity on his deliberate and consistent effort to base the test stimuli, the test tasks, and scoring procedures on the best theory and research now available. Analyses of the lives of indisputably eminent creative people, the nature of performances widely regarded as creative, and research and theory concerning the functioning of the human mind have been considered in making decisions on the selection of test tasks. In the general purpose batteries, an attempt has been made to keep the test tasks free of technical or subject matter content. The tasks in these batteries can be administered from kindergarten through graduate school. This makes it possible to determine whether children and young people identified as "creative" behave in ways similar to the ways eminent creative people of the past behaved when they were children and young people. One can also determine whether adults identified as creative today on the basis of outside criteria behave in creative ways on the basis of test scores.

A large proportion of the studies concerned with validity may be classified as tests of construct validity. Weisberg and Springer (1961) found that gifted preadolescents identified by the tests as creative compared with their equally gifted (as measured by tests of intelligence) peers were rated significantly higher on: strength of self-image, ease of early recall, humor, self awareness, uneven ego development, unconventional responses, fanciful and imaginative treatment of ink blots, independence from environmental influences, and readiness to respond emotionally to the environment. Fleming and Weintraub (1962) found a negative relationship between scores on the creative thinking tests and rigidity. Lieberman (1965) found significant relationships between creativity scores and measures of playfulness among kindergarten children. Long, Henderson, and Ziller (1965) found that the apparent social rejection associated with originality affects negatively the self-concepts of highly original elementary school children. Long and Henderson (1965) found that highly creative children identified by tests are better able than their less creative peers to withstand the uncertainty of an undecided state of affairs and to resist premature closure.

In studies of high school seniors, Dauw (1965) differentiated between good original thinkers and elaborators and between highly creative and less creative young people. All of the high groups in Dauw's sample were differentiated from the low groups by their total scores on the creative personality self-description checklist, the creative needs score of the Minnesota Importance Questionnaire, and a variety of life experience variables. The career aspirations of the highly original subjects tended to be creative and unconventional. The career aspirations of the good elaborators were less creative and unconventional than the highly original thinkers and the strength of their vocational needs as measured by the Minnesota Importance Questionnaire was weaker. The high elaborators tended to be more perfectionistic and to make higher grades than the highly original groups.

Dauw's High Originals and those high on both Originality and Elaboration tend to be characterized by concern about ridicule, restrictions on freedom, and pressures of time, while the High Elaborators are more frequently concerned about failure and inability to meet expectations. Those high on both do not appear to experience discomfort from nonconformity as frequently as do the Originals. Those high on Originality and those high on both seem to cope with stress by changes in strategies and new projects while the High Elaborators more frequently report using withdrawal strategies. All three of the creative subgroups rely quite frequently on absorption in work and creative activities and discussions of their problems with others. The High Originals reported more frequently than the other groups special problems involving parental disagreements and estrangement, while the other two groups reported concern about meeting the high expectations of their environment. In general, the environment of the High Originals does not seem to hold very high expectations of them, tending instead to disparage them and frustrate their craving for independence.

On the basis of the Runner Studies of Attitude Patterns (Runner and Runner, 1965), Dauw's creative seniors compared with a norm sample of young people of similar age, educational, and socio-economic status are characterized by high resistance to social pressure, low rules and tradition orientations, low needs for structure and directions, and low passive compliance. They were also low on control orientation and high on freedom, achievement, and recognition orientations. In general, the high creatives show greater willingness to commitments than do members of the unselected sample.

Weiser (1962), in a study of undergraduate students in education, found no differences in his high and low creative groups on teaching majors, preferences for elementary or secondary teaching, plans to obtain advanced degrees, or cumulative grade point averages. The high creatives, however, scored higher on the Professor scale of the Education Interest Inventory and eighty-nine of the 300 adjectives on a checklist significantly differentiated the two groups. Many of the adjectives are those commonly associated with adult creative personality, such as adventurous, courageous, determined, energetic, humorous, individualistic, industrious, and versatile. Hansen and Torrance (1965), in a study of the question-asking behavior of basic business teachers, found that the more creative teachers are more provocative and less often call for the reproduction of textbook information.

Another indication of construct validity is that the tests reflect growth resulting from various kinds of creative experiences and facilitating conditions. Other than the Torrance (1965a) and Torrance and Gupta (1964) studies, some of the more notable studies that show creative growth of this are those by Sommers (1961), Anderson (1963), DeRoche (1965), Crutchfield and Covington (1963), Cartledge and Krauser (1963), and Enochs (1964).

There have also been a variety of studies of concurrent validity but in general, these have been dogged by difficult problems of criterion construction. Some of these will be reviewed in the sections dealing with concerns about the relationships among creative thinking ability, intelligence, school achievement, teacher grades, and teacher identification of creative potentiality. A more exciting type of concurrent validity study is illustrated by the Clark (1964) and Hamburg (1964) studies of creative thinking ability and preferred ways of learning. Although the relationships were not unusually strong, there were in these studies indications that highly creative children prefer open-structured rather than closed-structure learning experiences more frequently than do their less creative peers. MacDonald and Raths (1964), in a carefully executed study found that highly creative children were more productive on frustrating tasks than were their less creative peers. The least creative children were less productive in open tasks and the most creative ones reacted less favorably to closed tasks.

Also rather rewarding have been the concurrent validity studies by Sommers (1961) of the creativity of industrial arts students and Wallace's (1961, 1964) studies of saleswomen and salesmen in a national sales organization.

The concurrent validity studies involving educational achievement will be summarized later in this paper.

A number of predictive validity studies are underway but obviously a considerable amount of time must elapse before such studies can be completed. One such study of elementary education majors by Torrance and Tan is nearing completion and another by Tan is underway. One such study involving University (Minnesota) High School seniors has been completed by Erickson (1966). These seniors, many of them highly gifted, were administered the tests of creative thinking in the fall of 1959 and followed up to ascertain their creative achievements in the winter and spring of 1966. Although a large proportion of these young people were either still in graduate school or in military service, they reported an impressive array of creative achievements. Using an index derived from the number and type of creative achievements reported, Erickson obtained product-moment coefficients of correlation with the creative thinking measures as follows: fluency, .27; flexibility, .24; originality, .17; and elaboration, .16 (N = 44). The originality score, in spite of its relatively low correlation, predicted successfully at better than the .05 level the following twelve kinds of checklist behavior thought to be associated with creative achievement: writing a story, song, play; writing a book; handling in-service training for co-workers; learning a new language; subscribing to professional journals; suggesting modifications of existing policies which were adopted by superiors and/or co-workers; receiving a grant for original research; having a scientific or scholarly paper published in a professional or scientific journal; being elected to a student office; giving a public recital; performing on radio or television; and developing an original experimental design in research. Most of these achievements were also predicted at the .05 level of confidence or better by the total or composite creative thinking score.

Studies of Test-Retest Reliability

The studies of test-retest reliability of the Torrance Tests of Creative Thinking have rather consistently indicated that reliabilities are higher for adults (Goralski, 1964; Mackler, 1962) and older children (Grover, 1963) than for younger children (Wodtke, 1963). Experience has also indicated that test-retest reliabilities, as well as validity coefficients, are greatly influenced by the motivational factors in the testing situation. This is perhaps more critical in this kind of testing than in personality, intelligence, and achievement testing, since the subject must produce responses himself and this requires more expensive energy than is required by the latter. Consistent motivation is perhaps easier to maintain in older than in younger subjects. Experience has also indicated that with good motivation and careful obtesting, especially in individual testing, that it is possible to obtain high test-retest reliability with even mentally retarded children. This is reflected in the work of Rouse (1965) who obtained test-retest reliabilities of .85, .76, and .68 on the fluency, flexibility, and originality scores of alternate forms of the Product Improvement Test with 31 mentally retarded youngsters with an elapsed time interval of six months.

Among the more carefully done studies involving all four forms of the Torrance Tests of Creative Thinking are: one involving a sample of 118 Wisconsin fifth graders and one by Hagender (1966) in a White Bear, Minnesota, school, involving 54 fifth grade children. Both his experimental and control groups were administered Verbal and Figural Forms A in September, and Verbal and Figural Forms B exactly eight months later. The following test-retest reliabilities were obtained:

	Hagender Experimental Group (N=28)	Hagender Control Group (N=26)	Wisconsin Sample (N=118)
Verbal Fluency	.87	.79	.93
Verbal Flexibility	.84	.61	.84
Verbal Originality	.79	.73	.88
Figural Fluency	.50	.80	.71

	Experimental Group (N=28)	Control Group (N=26)	Wisconsin (N=118)
Figural Flexibility	.63	.64	.73
Figural Originality	.60	.60	.85
Figural Elaboration	.71	.80	.83

Measures of Intelligence and Creativity

Perhaps the most frequent concern of master's theses has been with the relationship between measures of intelligence and measures of creative thinking ability. The author has rather consistently obtained small but positive and sometimes statistically significant relationships between these two types of measures. The relationships have rather consistently been higher for girls than for boys, for the lower half or lower quarter of the intelligence continuum than for the upper half or quarter, for verbal than for figural measures, for fluency and elaboration than for originality. Most of the studies that have been reported have failed to give consideration to these and other dynamics of the relationships involved.

A look at the total picture presented by these studies is illuminating and may be of use to future investigators. A tabulation was made of the reported product-moment coefficients of correlation between measures of intelligence and the various versions of the Torrance Tests of Creative Thinking in all of the reports available in his files at the time this is being written. In many cases, only abstracts were available and these did not generally give exact coefficients of correlation and these were not used. The results of this tabulation are presented in Table 1. It will be observed that from a total of 178 coefficients of correlation between measures of intelligence and a total or composite measure of creative thinking ability the median is .20. The median of the 88 coefficients between intelligence and verbal creativity is .21 and the median of the 114 coefficients of correlations between intelligence and figural creativity is .06.

Insert Table 1 about here

These data impress one with the futility of doing simple correlation studies of the relationship between measures of intelligence and creative thinking ability. There is a need to take into consideration the nature of both kinds of measures, the sex and age of the subjects, the range of the intelligence test scores, and motivational factors. Although the studies represented by the distributions given in Table 1 contain coefficients of correlation that are both higher and lower than

Table 1

Distributions of Product-Moment Coefficients of Correlation Between Scores on Intelligence Tests and Scores on Creative Thinking Tests

Coefficient of Correlation	Total		Verbal		Figural	
	Freq.	Cum. Freq.	Freq.	Cum. Freq.	Freq.	Cum. Freq.
.60 or above	3	3	1	1	0	0
.50 to .59	10	13	2	3	0	0
.40 to .49	13	26	5	8	4	4
.30 to .39	28	54	9	17	3	7
.20 to .29	36	90	30	47	14	21
.10 to .19	33	123	19	66	25	46
.00 to .09	27	150	5	71	29	75
-.01 to -.10	17	167	9	80	26	101
-.11 to -.20	7	174	5	85	8	109
-.21 to -.30	4	178	3	88	4	113
-.31 to -.40	0	178	0	88	1	114
Median	.20		.21		.06	

any obtained by the author, the central tendencies are about the same. These extensions of the Minnesota Studies also support the general findings reviewed in the first paragraph of this section.

Measures of Achievement, Teacher Grades, and Teacher Identification

From the available reports already described, tabulations were also made of the product-moment coefficients of correlation between measures of creative thinking ability and measures of school achievement based on standardized tests, teacher grades, and teacher estimates of creative potential. The results of these tabulations are presented in Table 2. It will be noted that the median of the 65 coefficients of correlation between creativity measures and standardized measures of school achievement is .28. Eight of the reported coefficients of correlation, however, are negative. A few of the reported studies take into consideration such factors as the nature of the kind of achievement assessed, the methods of instruction, and the like.

Insert Table 2 about here

In general, the coefficients of correlation obtained by the author and his students have tended to be higher than those reported in Table 2, especially when the methods of instruction have been such as to give a chance to use the creative thinking abilities in the learning process or when the assessment procedures involve creative kinds of performance. Bentley's (1966) study of different methods of assessing achievement in a college course in Educational Psychology provides a good example of the latter. He obtained a coefficient of correlation of .53 between scores on the Torrance Tests of Creative Thinking and scores on a test of achievement requiring applications of the knowledge acquired. The coefficient of correlation was .03 on a multiple-choice test requiring the recognition of the correct answer; on tests requiring memory, he obtained a correlation of .11 and on tests involving evaluation, one of .38. The Miller Analogies Test, however, correlated only .37 with scores on the creative applications test, but .47 with the multiple-choice test, .41 with the memory test, and .36 with the evaluation test; In a school where children had considerable opportunity to learn in creative ways, Bowers (1959) obtained coefficients of correlation ranging from .52 to .63 between a composite measure of creativity and measures of educational achievement in the intermediate grades. When he partialled out the effects of intelligence, he obtained coefficients of correlation ranging from .28 to .48. Bish (1964) obtained results at about the same level except that generally the coefficients of correlation were raised when corrections were made for the effects of intelligence. In a junior high school, Bowers (1966) obtained coefficients of correlation ranging from .57 to .84 between a composite measure of creativity and a composite

Table 2

Distributions of Product-Moment Coefficients of Correlation Between Creative Thinking Test Scores and Measures of School Achievement Teacher Grades, and Teacher Estimates of Creative Potential

Coefficient of Correlation	Achievement Test		Teacher Grades		Teacher Ident.	
	Freq.	Cum. Freq.	Freq.	Cum. Freq.	Freq.	Cum. Freq.
.70 or above	2	2	0	0	0	0
.60 to .69	4	6	1	1	1	1
.50 to .59	9	15	8	9	7	8
.40 to .49	9	24	11	19	5	13
.30 to .39	7	31	22	41	7	20
.20 to .29	8	39	21	62	8	28
.10 to .19	12	51	20	82	8	36
.00 to .09	6	57	18	100	1	37
-.01 to -.10	5	62	8	108	1	38
-.11 to -.19	2	64	0	108	2	40
-.20 to -.29	1	65	2	110	0	40
-.30 to -.39	0	65	4	114	0	40
Median	.28		.21		.20	

measure of achievement (Iowa Tests of Educational Development). In this study, Bowers demonstrated that both intelligence and creativity contribute to educational achievement but that creativity contributes more at the lower levels of intelligence than at the upper levels.

It is of interest to note that there is a generally lower relationship between school achievement as measured by teacher grades than when measured by standardized tests. Relationships between teacher estimates of pupil creativity and measures of creative thinking ability are at approximately the same level. These findings suggest that tests of creative thinking ability might profitably be used to aid teachers in becoming aware of potentialities that they might otherwise overlook. Regardless of the limitations that the tests might possesss, this would seem to be one of the strong assets.

Other Problems Studied

A relatively large number of studies have been concerned with the evaluation of the effectiveness of experimental procedures and materials designed to facilitate creative development. Studies by Barone (1963), Casey (1965), and Eberle (1965) are examples of experiments demonstrating creative growth following the use of experimental materials, exercises in creative thinking, and the like. A study reported by Cartledge and Krauser (1963) indicate that such materials can be effective at least as low as the first grade and one by Rouse (1965) indicates that such materials can be developed for use with mentally retarded children. One by Enochs (1964) indicates that it is possible to develop materials for use in in-service teacher education that will result in changed teacher behavior and creative growth among children.

A number of studies have been concerned with relationships between personality variables and creative functioning. The studies of Dauw, Fleming and Weintraub, and Weisberg and Springer have already been reviewed. MacGregor (1964), in a study involving fourth, fifth, and sixth grade pupils, found that the child who sees himself as able to exert some control over events in his life and is able to rely on his own standards of judgment is better able to produce original test responses than the child who feels himself the prey of others or who feels he must rely upon the judgments of others. On the basis of rather intensive personality studies of counselor trainees attaining high and low creativity scores, Gust (1964) developed the following composite picture of the more creative counselor trainee. He was rated higher than his less creative peers on counseling effectiveness by practicum supervisors; showed better capacity to tolerate tensions arising from polar opposite needs of succorance and nurturance; had a low degree of compulsion to keep at a job until it is finished; was able to subordinate feelings and conflicts; was capable of taking greater risk in the hope of greater gains; was less interested in the empirical, critical, and rational; was not aiming to order and systematize knowledge; and was not interested in occupations that might involve directing someone or in following rather organized plans without significant deviations or intuitive judgments entering the process.

Other studies have dealt with such problems as the role of learning preferences, preferred type of teacher-student relationship, perception of one's teacher-student relationship, socio-economic status, child rearing procedures, delinquency, mental retardation, blindness, deafness, and the like in creative development. Problems concerning the common discontinuities of creative development, especially at about the fourth and seventh grades, have also claimed some attention. Already, these studies have provided some useful clues for practice and some promising leads for further research. As research accumulates and gets away from some of the apparent fixations of the past, more dependable guides should be forthcoming.

In the fall of 1966, what had been labeled the Minnesota Studies of Creative Behavior became the Georgia Studies of Creative Behavior. What one researcher or group of researchers can do, however, is small indeed compared to the effort represented by the extended studies highlighted in this section.

III PUBLICATIONS IN OPEN SOURCES RELATED TO THE MINNESOTA STUDIES OF CREATIVE THINKING

This is a list of publications which have appeared in open sources concerning the Minnesota Studies of Creative Thinking. Most of these publications should be available in most college, university, and public libraries. The books are still available from the publishers and should be ordered from them rather than from the Bureau of Educational Research or from the authors.

1. Brecher, Ruth and Edward. "Creative Ability -- What is it? Who has it? What Makes it Flourish?" Parents Magazine, November, 1960.

2. Brossard, Chandler. "The Creative Child." Look Magazine, Nov. 7, 1961.

3. Cook, Joan. "Diagnosis: This Child is Creative." Glamour, January 1963, 48(5), 104ff.

4. Cook, W. W. and E. P. Torrance. "The Educated Man is Creative." Minnesota Journal of Education, October 1960, 41(3), 17-20.

5. Cunnington, B. F. and E. P. Torrance. Sounds and Images: Adult Version. (Album and Teachers Guide.) Boston: Ginn and Co., 1965.

6. Cunnington, B. F. and E. P. Torrance. Sounds and Images: Elementary Version. (Album and Teachers Guide.) Boston: Ginn and Co., 1965.

7. Cunnington, B. F. and E. P. Torrance. Messages for the Millions (The Alexander Graham Bell Story) and Commander of Communication (The Samuel F. B. Morse Story). Boston: Ginn and Co., 1965.

8. Cunnington, B. F. and E. P. Torrance. All-Around American (The Benjamin Franklin Story) and Superman of Steam (The Robert Fulton Story). (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

9. Cunnington, B. F. and E. P. Torrance. Wings for the World (The Wright Brothers Story) and Wizard on Wheels (The Henry Ford Story). (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

10. Cunnington, B. F. and E. P. Torrance. Master of Miracles (The Thomas Edison Story) and Trailblazer to the Stars (The Robert Goddard Story). (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

11. Cunnington, B. F. and E. P. Torrance. Survival Scientist (The Vilhjalmur Stefanson Story) and Captains of Courage (The Lewis and Clark Story). (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

12. Cunnington, B. F. and E. P. Torrance. Sweetheart of the Skies (The Amelia Earhart Story) and Polar Pilot (The Richard Byrd Story). (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

13. Cunnington, B. F. and E. P. Torrance. Giovanni and the Giant and The Dog They Named King. (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

14. Cunnington, B. F. and E. P. Torrance. The Blue Crystal and the Minstrel's Christmas. (Album and Teachers' Guide). Boston: Ginn and Co., 1965.

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